AF/2662 #18

Docket No.: GR 97 P 8073

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MAIL STOP: APPEAL BRIEF-PATENTS

By: ______________________ Date: September 8, 2003

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Before the Board of Patent Appeals and Interferences

Applicant	:	Stefan Bahrenburg et al.
Applic. No.	:	09/494,780
Filed	:	January 31, 2000
Title	:	Method and Radio Station for Data Transmission
Examiner	:	John Pezzlo - Art Unit: 2662

BRIEF ON APPEAL

Hon. Commissioner for Patents,
Alexandria, VA 22313-1450

S i r :

This is an appeal from the final rejection in the Office action dated April 8, 2003, finally rejecting claims 1-4, 6, 9 and 11-15.

Appellants submit this *Brief on Appeal* in triplicate, including payment in the amount of $320.00 to cover the fee for filing the *Brief on Appeal*.

Real Party in Interest:

This application is assigned to Siemens Aktiengsellschaft of München, Germany. The assignment will be submitted for recordation upon the termination of this appeal.

Related Appeals and Interferences:

No related appeals or interference proceedings are currently pending which would directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

Status of Claims:

Claims 1-4, 6, 9, and 11-15 are rejected and are under appeal.

Status of Amendments:

No claims were amended after the final Office action. *A Response under 37 CFR §1.116* was filed on July 11, 2003. The Primary Examiner stated in an *Advisory Action* dated June 27, 2003, that the amendment after final would be entered upon the filing of a *Notice of Appeal.*

Summary of the Invention:

As stated in the first paragraph on page 1 of the specification of the instant application, the invention lies in the communications field. More specifically, the

invention relates to a method and a radio station for data transmission via a radio interface in a radio communications system, in particular a mobile radio network.

Appellants explained on page 10 of the specification, line 22, that, referring now to the figures of the drawing in detail and first, particularly, to Fig. 1 thereof, there is seen a structural representation of a radio communications system corresponding to that of a known GSM mobile radio network. The system comprises a large number of mobile switching centers MSC, which are networked to one another and produce the access to a fixed network PSTN. Furthermore, these mobile switching centers MSC are connected to in each case at least one base station controller BSC. Each base station controller BSC in turn allows a connection to be set up to at least one base station BS. Such a base station BS is a radio station which can use a radio interface to set up a radio link to mobile stations MS.

Appellants outlined on page 11 of the specification, line 10, that, by way of example, Fig. 1 shows three radio links for transmitting useful, i.e., wanted information ni and signaling information si between three mobile stations MS and one base station BS, with one mobile station MS being assigned to two data channels DK1 and DK2, and the other

mobile stations MS each being assigned one data channel DK3 or DK4, respectively. An operation and maintenance center OMC provides monitoring and maintenance functions for the mobile radio network, or for parts of it. The functionality of this structure is used by the radio communications system according to the invention. It should be understood, however, that the concepts of the invention can also be transferred to and utilized in other radio communications systems.

Appellants further outlined on page 10 of the specification, line 24, that the base station BS is connected to an antenna device which comprises, for example, three individual radiating elements. Each of the individual radiating elements transmits directionally into one sector of the radio cell which is supplied by the base station BS. However, alternatively, a greater number of individual radiating elements (as per adaptive antennas) may be used, so that it is also possible to use space subscriber separation based on an SDMA method (space division multiple access).

It is stated on page 12 of the specification, line 8, that the base station BS provides the mobile stations MS with organization information relating to the location area (LA) and relating to the radio cell (radio cell identification). The organization information is transmitted at the same time

via all the individual radiating elements of the antenna device.

It is also outlined on page 12 of the specification, line 15, that the connections together with the wanted information ni and the signaling information si between the base station BS and the mobile stations MS are subject to multipath propagation, which is caused by reflections, for example buildings, in addition to the direct propagation path. Directional transmission from specific individual radiating elements in the antenna device AE results in a higher antenna gain than for omnidirectional transmission. Directional transmission improves the quality of the connections.

It is explained in the last paragraph on page 12 of the specification, line 25, that, if it is assumed that the mobile stations MS are moving, then multipath propagation together with other interference sources leads to the signal components from the various propagation paths of a subscriber signal being superimposed as a function of time at the receiving mobile station MS. Furthermore, it is assumed that the subscriber signals of different base stations BS are superimposed at the reception location to form a received signal rx in one frequency channel. The function of a receiving mobile station MS is to detect data d, transmitted

in the subscriber signals, relating to the wanted information ni, signaling information si and organization information data.

Appellants outlined on page 13 of the specification, line 12, that, referring now to Fig. 2, there is shown the frame structure of the radio interface. Based on a TDMA component, a broadband frequency range, for example with a band width of B = 1.6 MHz, is split into a plurality of time slots ts, for example 8 time slots ts1 to ts8. Each time slot ts within the frequency range B forms a frequency channel. Information from a plurality of connections is transmitted in bursts within the frequency channels that are provided for wanted data transmission. Based on an FDMA (frequency division multiple access) component, a plurality of frequency ranges B are assigned to the radio communications system.

Appellants further stated on page 13 of the specification, line 24, that, referring now to Fig. 3, the bursts for wanted data transmission comprise data parts with data symbols d, in which sections with midambles m are known at the receiving end are embedded. The midambles may also be referred to as interblock sequences. The data d are spread on a connection-specific basis using a fine structure, a spread code, so that, for example, K data channels DK1, DK2, DK3,.. DKK can

be separated by means of this CDMA component at the receiving end. Each of these data channels DK1, DK2, DK3,.. DKK is assigned a specific energy E per symbol at the transmitting end.

As set forth on page 14 of the specification, line 9, the spreading of individual symbols in the data d with Q chips results in Q sub-sections of duration Tc being transmitted within the symbol duration Ts. The Q chips in this case form the individual spread code. The midamble m comprises L chips, likewise of duration Tc. Furthermore, the time slot ts includes a guard time of duration Tg in order to compensate for different signal propagation times for connections in successive time slots ts.

It is outlined in the last paragraph on page 14 of the specification, line 18, that, within a broad band frequency range B, the successive time slots ts are broken down on the basis of a frame structure. Eight time slots ts are thus combined for one frame, with one specific time slot in the frame forming a frequency channel for wanted data transmission, and being used repeatedly by a group of connections. Further frequency channels, for example for frequency or time synchronization of the mobile stations MS are not inserted into each frame, but are inserted at

predetermined times within a multiframe. The intervals between these frequency channels govern the capacity which the radio communications system has available for this purpose.

As stated on page 15 of the specification, line 4, the radio interface parameters are, for example, as follows:

Duration of a burst	577 µs
Number of chips per midamble m . .	243
Guard time Tg	32 µs
Data symbols per data part N . . .	33
Symbol duration Ts	6.46 µs
Chips per symbol Q	14
Chip duration Tc	6 / 13 µs

As further outlined on page 15 of the specification, line 13, the parameters may also be set differently in the uplink (MS → BS) and downlink (BS → MS) directions.

Appellants also explained on page 15 of the specification, line 16, that the transmitters and receivers shown in Fig. 4 and Fig. 5, respectively, relate to radio stations which may be either a base station BS or a mobile station MS. However, only the signal processes for one connection is shown.

It is described in the last paragraph on page 15 of the specification, line 21, that the transmitter shown in Fig. 4 receives the previously digitized data symbols d from a data source (microphone or connection on the network side), with the two data parts being processed separately and each having N=33 data symbols d.

Appellants outlined on page 16 of the specification, line 1, that channel coding is carried out first of all, at a rate 1/2 and with a constraint length 5 in a convolution encoder FC, which is followed by scrambling in an interleaver I, with a scrambling depth of 4 or 16.

Appellants also stated on page 16 of the specification, line 6, that the scrambled data are then 4-PSK modulated in a modulator MOD, are converted into 4-PSK symbols and are then spread in spreading means SPR using appropriate individual spread codes. This processing is carried out in a data processing means DSP in parallel for all the data channels DK1, DK2 for one connection. The illustration does not show that the other connections are likewise processed in parallel in a base station BS. The data processing may be carried out by a digital signal processor, which is controlled by a control device SE.

It is set forth in the last paragraph on page 16 of the specification, line 17, that the spread data for the data channels DK1 and DK2 are superimposed in an adder S, with the data channels DK1 and DK2 being given the same weighting for this superimposition. The discrete-time representation of the transmitted signal s for m-th subscriber may be produced using the following equation,

$$s_{q+(n-1)Q}^{(m)} = \sum_{k=1}^{K(m)} d_n^{(k,m)} c_q^{(k,m)}, \text{ where } q = 1..Q, n = 1..N$$

Appellants explained on page 17 of the specification, line 1, that, in this case, K(m) is the number of data channels for the m^{th} subscriber, and N is the number of data symbols d per data part. The superimposed subscriber signal is supplied to a burst former BG which assembles the burst, taking account of the connection-specific midambles m.

Appellants further explained on page 17 of the specification, line 7, that, since complex CDMA codes are used, which are derived from binary CDMA codes by multiplication by j^{q-1}, the output signal of a chip impulse filter CIF which follows the burst former BG is GMSK-modulated and has an approximately constant envelope if the connection uses only one data

channel. The chip impulse filter CIF carries out convolution, using a GMSK main impulse.

It is also states on page 17 of the specification, line 14, that, after digital signal processing, digital/analog conversion, conversion to the transmission frequency band and amplification of the signal are carried out at the transmitting end. The transmitted signal is then transmitted via the antenna device and, possibly via different transmission channels, reaches the receiving radio station, for example a mobile station MS.

Appellants outlined in the last paragraph on page 17 of the specification, line 22, that one individual midamble m comprising L complex chips is in this case used per connection. The M different midambles required are derived from a basic midamble code of length M * W, where M is a maximum number of subscribers (connections) and W is the expected maximum number of values for the channel impulse response h. The connection-specific midamble m is derived by rotation to the right of the basic midamble code through W * m chips and by periodic expansion up to L > (M + 1)* W - 1 chips. Since the complex basic midamble code is derived from a binary midamble code by modulation with j^{q-1}, the

transmitted signal for the midamble m is likewise GMSK-modulated.

Appellants stated on page 18 of the specification, line 9, that analog processing at the receiving end, that is to say amplification, filtering, and conversion to baseband, is followed by digital low-pass filtering of the received signals e in a digital low-pass filter DLF. A part of the received signal e, which is represented by a vector em of length L = M * W and does not include any interference in the data part, is passed to a channel estimator KS. The channel estimation of all M channel impulse responses h is carried out using

$$h = \mathrm{IDFT}\,(\mathrm{DFT}\,(em)g)$$

where

$$g = (\mathrm{DFT}\,(sm))^{-1}.$$

Appellants further stated on page 18 of the specification, line 24, that the data estimation in the joint detection data estimator DE is carried out jointly for all of the connections. The spread codes are represented by $c^{(k)}$, the

received data $d^{(k)}$, and the corresponding channel impulse responses by $h^{(k)}$, where $k = 1$ to K.

It is outlined on page 19 of the specification, line 4, that the part of the received signal which is used for the data estimation is described by the vector

$$e = A \cdot d + n$$

where A is the system matrix with the *a-priori* of known CDMA codes $c^{(k)}$ and the estimated channel impulse responses $h^{(k)}$. The vector d is a combination of the data $d^{(k)}$ for each data channel based on the following equation:

$$\mathbf{d} = \left[\mathbf{d}_1^{(1)}, \mathbf{d}_1^{(2)}, \ldots \mathbf{d}_1^{(K)} \ldots \mathbf{d}_N^{(1)} \ldots \mathbf{d}_N^{(K)}\right]$$

It is further outlined on page 19 of the specification, line 16, that, for this symbol arrangement, the system matrix A has a band structure, which is used to reduce the complexity of the algorithm. The vector n includes the noise element. The data estimation is carried out by means of a zero forcing block linear equalizer (ZF-BLE) using the following equation:

$$d = (A^{*T}A)^{-1}A^{*T}e.$$

Appellants stated in the last paragraph on page 19 of the specification, line 24, that the components have a continuous value and are non-manipulated estimated values of the data symbols d. In order to simplify the calculation of d, the problem can be rewritten as a linear equation system in the form

$$(A^{*T}A)d = A^{*T}e$$

where, based on a Cholesky breakdown,

$$A^{*T}A = H^{*T}H$$

the determination of the data symbols d is reduced to solution of the following two systems of linear equations

$$H^{*T}z=A^{*T}e \qquad \text{with} \qquad H\cdot d = z.$$

These equation systems may be solved recursively. H is an upper triangular matrix and H^{*T} is a lower triangular matrix.

As described on page 20 of the specification, line 18, the data estimation described here is applicable to one individual data part. Furthermore, it is necessary to consider the interference between the midamble m and the data

parts for the data estimation. After the separation of the data symbols in the data channels DK1 and DK2, demodulation is carried out in a demodulator DMO, unscrambling in a deinterleaver DI, and channel decoding in a convolution decoder FD.

Appellants explained on page 21 of the specification, line 1, that, at both the transmitting and receiving ends, the digital signal processing is controlled by a control device SE. The control device SE takes account, in particular, of the number of data channels DK1, DK2 per connection, the spread codes of the data channels DK1, DK2, the actual burst structure, and the requirements for channel estimation.

Appellants further explained on page 21 of the specification, line 8, that, in particular, the control device SE influences the superimposition of the data symbols d in the adder S. This allows the data symbols in the various data channels DK1, DK2 to be kept in different weightings. Apart from equal weighting, data symbols d in a first category (for example signaling information) may also be given higher weightings. The control device SE likewise controls the burst former BG, and thus sets the energy per symbol. The energy per symbol is in this case the same in the data parts and in the midamble

m. In certain traffic conditions, the data parts may also be given a higher weighting.

It is stated in the last paragraph on page 21 of the specification, line 20, that, referring now to Fig. 6, there is shown one frame of the TDMA structure of the radio interface. The assignment of the connections V1 to V10 to individual time slots ts1, ts2, ts3 is carried out on the network side. In this case, it is necessary to remember that only a limited number of channel impulse responses h can be estimated jointly per time slot ts. This limitation results from the fact that the channel impulse responses contain L chips, the channel impulse responses have W coefficients for accurate channel estimation, and M represents the number of connections per time slot. The number of channel impulse types which can be estimated jointly is in this case limited by the inequality $L > M * W + W - 1$.

Appellants outlined on page 22 of the specification, line 7, that the assignment strategy thus provides for approximately the same number of connections to be transmitted in each time slot ts. From a second point of view, it is possible to take account of the number of data channels per connection, so that, for example, a greater number of connections are

transmitted in the time slot ts2, in which the connections V4 to V7 have fewer data channels per connection.

It is also stated on page 22 of the specification, line 15, that, by using a common midamble m for a number of data channels DK1 and DK2, it is possible to transmit a greater number of data channels DK1 and DK2 in one time slot ts. This leads to an increase in the data rate per time slot ts, or to lengthening of the channel impulse responses h (for complex terrain structures) which can be estimated in this time slot ts.

Appellants stated in the last paragraph on page 22 of the specification, line 22, that, referring now to Fig. 7, there is shown a further influence on the data rate. This is not based on the assumption of a constant burst structure, but allows the control device SE to change the burst structure. The length of the midamble m can be matched to the terrain conditions. In the case of complicated terrain conditions, for example in mountain ranges, or in fjords, the length of the midamble m is lengthened at the expense of the data parts. In simple terrains, for example on flat land, the midamble m can be shortened. The burst structure is advantageously defined on the basis of radio cells. However, it is also possible to vary the midamble length individually

from one connection to another, in which case connections V1, V2, V3 of one burst structure are then advantageously assigned to a common time slot ts1.

As described on page 23 of the specification, line 12, the length of the midamble m in this case corresponds approximately to the length of the channel impulse response h to be estimated, that is to say the channel impulse response is short, for example, W = 3, for simple terrain structures, and is long, for example W = 7, for complicated terrain conditions.

It is stated in the last paragraph on page 23 of the specification, line 19, that the mobile radio network described in the exemplary embodiments and using a combination of FDMA, TDMA and CDMA is suitable for 3rd generation system requirements. In particular, it is suitable for implementation in existing GSM mobile radio networks, where only a minor amount of modification is required. The design of dual-mode mobile stations MS, which operate both in accordance with the GSM Standard and in accordance with the proposed TD/CDMA Standard, is simplified.

As appellants set forth on page 24 of the specification, lien 1, that the increase in the data rates per time slot by using

common midambles (channel pooling) makes it possible to set variable data rates step-by-step of, for example, K times 13 kbit/s.

References Cited:

U.S. Patent No. 5,511,068 (Sato), dated April 23, 1996.

Issues

1. Whether or not claims 1-4, 6, 9, and 11-15 are anticipated by Sato under 35 U.S.C. §102(b).

Grouping of Claims:

Claims 1 and 11 are independent. Claims 2-10 depend on claim 1 and claims 12-15 depend on claim 11.

Arguments:

CLAIMS 1-4, 6, 9, AND 11-15 ARE NOT ANTICIPATED BY SATO UNDER 35 U.S.C. §102(B)

Claim 1 includes a step of utilizing for at least two of the data channels of the connection one common training sequence different from training sequences of other connections.

Similarly, claim 11 includes a signal processor using for at least two of the data channels of the connection one common

training sequence different from training sequences of other connections.

On page 4 of the Office action, the Examiner has alleged that Sato shows using a single training sequence per connection and that the same training sequence is thus used for each channel or time slot of the connection. This assertion is incorrect. Sato does not teach using a common training sequence for at least two data channels.

It can be seen from col. 9, lines 26 to 29 that each channel in Sato has a different training sequence within the same time slot. The passage states, "The training signal series may have a pattern known in the art and may be formed by a code series **peculiar to each channel** so as to distinguish among the channels which use a common time slot TM" (emphasis added).

The feature in claim 1 that the same training sequence is used in different channels of the same connection can under no circumstances be derived therefrom. The passage in col. 9, lines 18 to 52 cited by the Examiner does not teach that the training sequences are chosen to be the same in such a case.

Sato does not teach utilizing for at least two of the data channels of the connection one common training sequence different from training sequences of other connections as specified in claims 1 and 11. The claimed invention is based on the knowledge that in a connection, it is advantageous to choose the same training sequence in two channels with different spread codes.

The next point of contention regards the individual spreading code. Claim 1 specifies that the data channels can be distinguished by an individual spreading code. Claim 11 specifies that each data channel can be distinguished by an individual spreading code.

In the response to arguments on page 4 of the Office action, the Examiner asserts that it is supposedly possible in Sato for two time slots, for example, to be assigned to one connection, whereby each time slot represents one channel. This is correct, however, the Examiner's further assertion - that in Sato an individual spreading code is assigned to each of these channels or time slots - is incorrect. The Examiner refers to Figs. 2 and 3 as well as to col. 5, lines 4 to 23. The cited test passages do not disclose any such thing. Instead, it can be seen beginning at col. 5, line 7, that an individual spreading code c is individually assigned to the

mobile station MS1. The fact that the expression "spread codes" is listed in plural is only a typographical or translational error, as can be seen from the subsequent specification. See col. 5, line 14, and line 16, where spread code is written in singular and it is stated in lines 14-16 that this individual spread code or the "spread code sequence" has c M-chips. It can be seen from Fig. 3 that the bits 1 to N illustrated in the second line are each spread with the M-chips of the spread code c. The third line of Fig. 3 thus shows repetitions of the spread code c with M-chips for the N-bits of a time slot N. Fig. 3, however, does not pertain to the case that two time slots are assigned to the same connection. Rather, it follows from the above-mentioned text passage in lines 7 onward of col. 5 that the spread code c, which is specific for the individual mobile station MS1, is the same code even when several time slots are provided per connection in each of these time slots for the same mobile station MS1. Otherwise, one could no longer speak of a specific spread code c that is specific for the mobile station MS1. The Examiner's determination that in Sato each time slot of the connection of an individual mobile station has an individual spread code is incorrect.

The honorable Board is therefore respectfully urged to reverse the final rejection of the Primary Examiner.

Respectfully submitted,

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For Appellants

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Appendix - Appealed Claims:

1. A method for data transmission via a radio interface in a radio communications system, which comprises the following steps:

assigning one connection via a radio interface a given number of at least two data channels, whereby the data channels can be distinguished by an individual spreading code;

transmitting in the data channels data symbols and, in addition, training sequences with known symbols; and

utilizing for at least two of the data channels of the connection one common training sequence different from training sequences of other connections.

2. The method according to claim 1, which comprises using one common training sequence for all of the data channels of the connection.

3. The method according to claim 1, which comprises superimposing the data symbols for the at least two data channels of a connection in the transmitter.

4. The method according to claim 3, which comprises superimposing the data symbols with equal weighting.

6. The method according to claim 1, wherein a ratio of a mean power per symbol between the training sequences and the data symbols is variable.

9. The method according to claim 1, wherein the data channels have different data rates.

11. A radio station for data transmission in a radio communications system via a radio interface, comprising:

a control device for assigning at least two data channels to a connection in a radio communications system;

wherein each data channel can be distinguished by an individual spreading code, and

wherein data symbols and, in addition, training sequences with known symbols are transmitted in a data channel;

a signal processor using for at least two of the data channels of the connection one common training sequence different from training sequences of other connections.

12. The method according to claim 1, wherein the training sequence is a midamble.

13. The radio station according to claim 11, wherein at least one of said training sequences is a midamble.

14. The method according to claim 1, wherein the code is an individual direct sequence spreading code.

15. The radio station according to claim 11, wherein the code is an individual direct sequence spreading code.